Oct. 18, 1966 K. R. LEWIS ETAL 3,279,114

GRENADE LAUNCHER

Filed Sept. 25, 1964 4 Sheets-Sheet 2

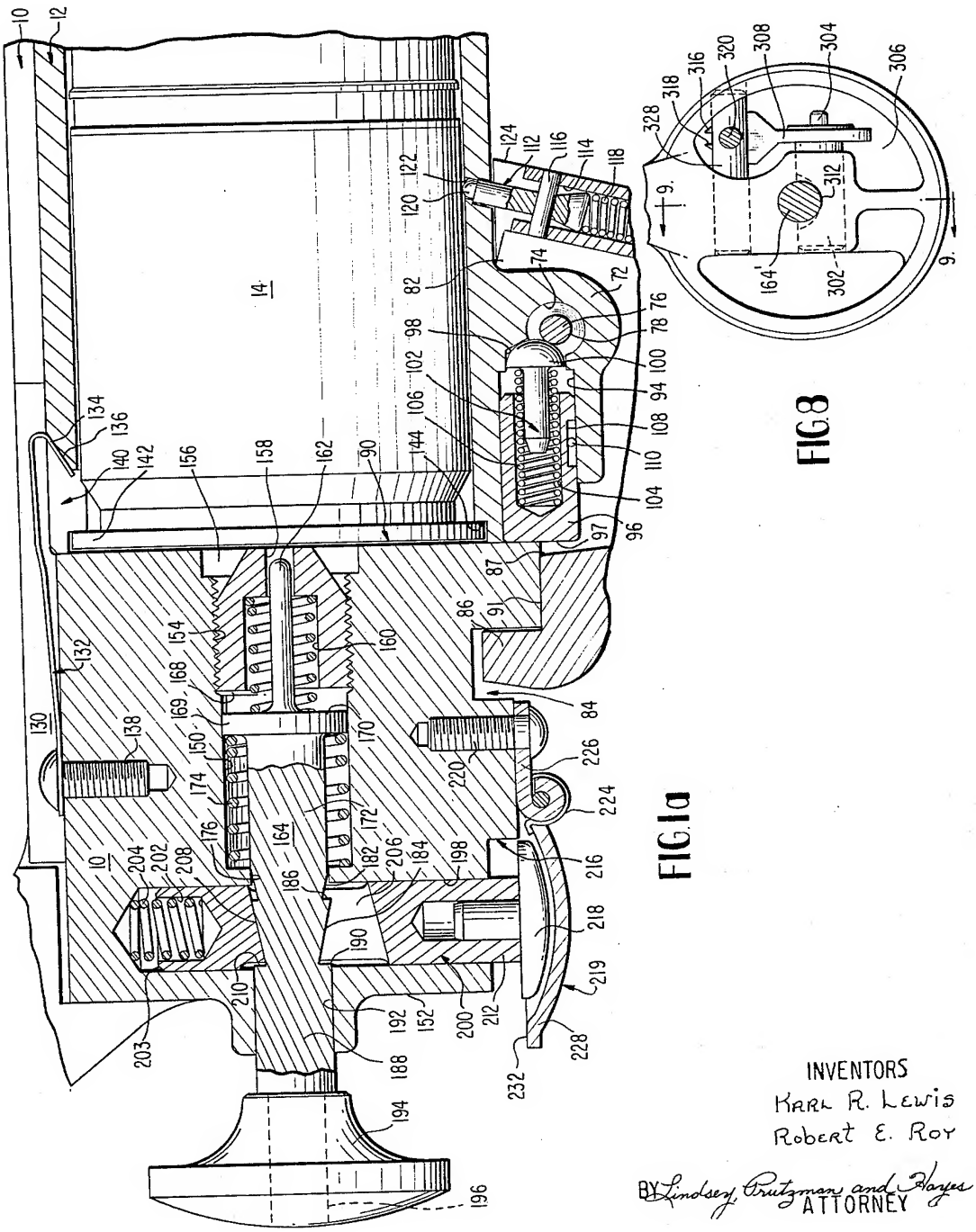

FIG. 1a

FIG. 8

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GRENADE LAUNCHER

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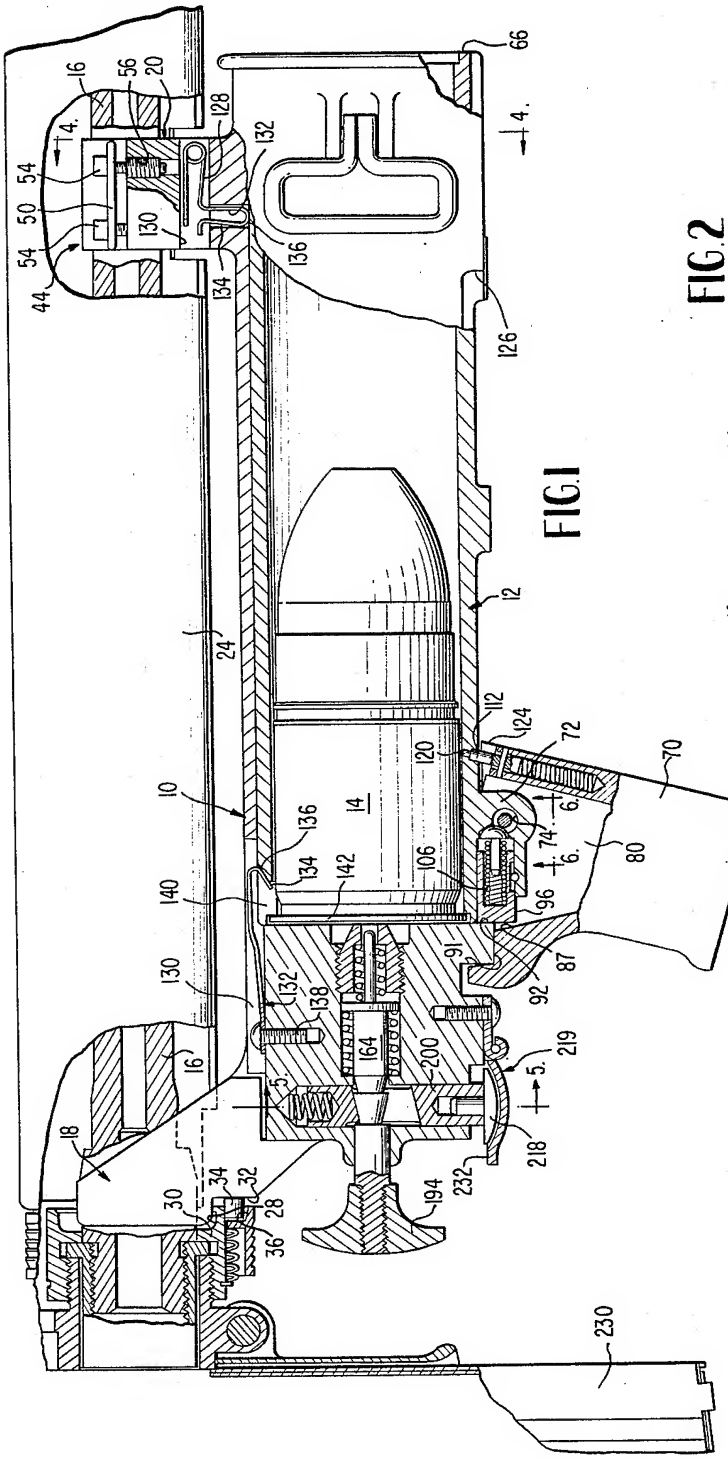

FIG. 1

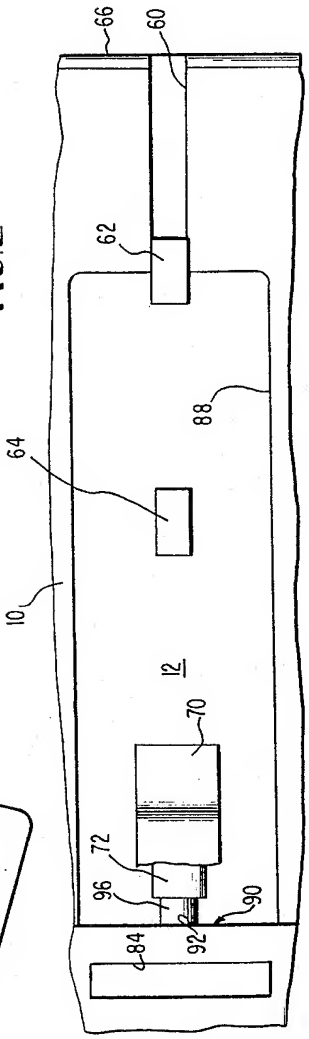

FIG. 2

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GRENADE LAUNCHER

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FIG. 3

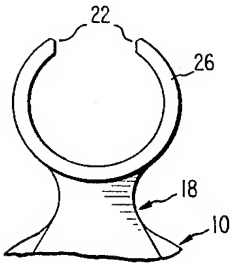
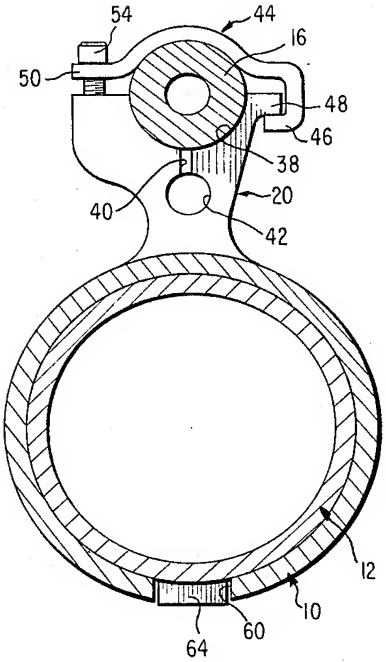


FIG. 4



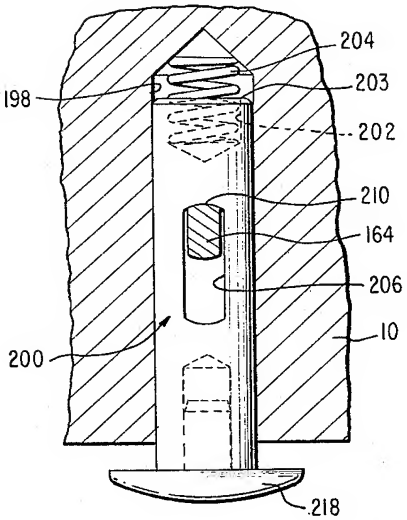


FIG. 5

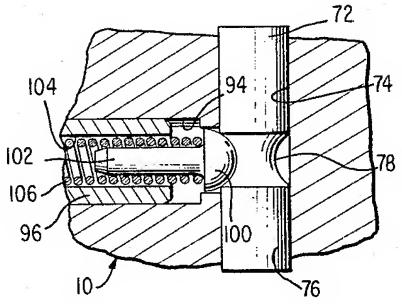


FIG. 6

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FIG. 7

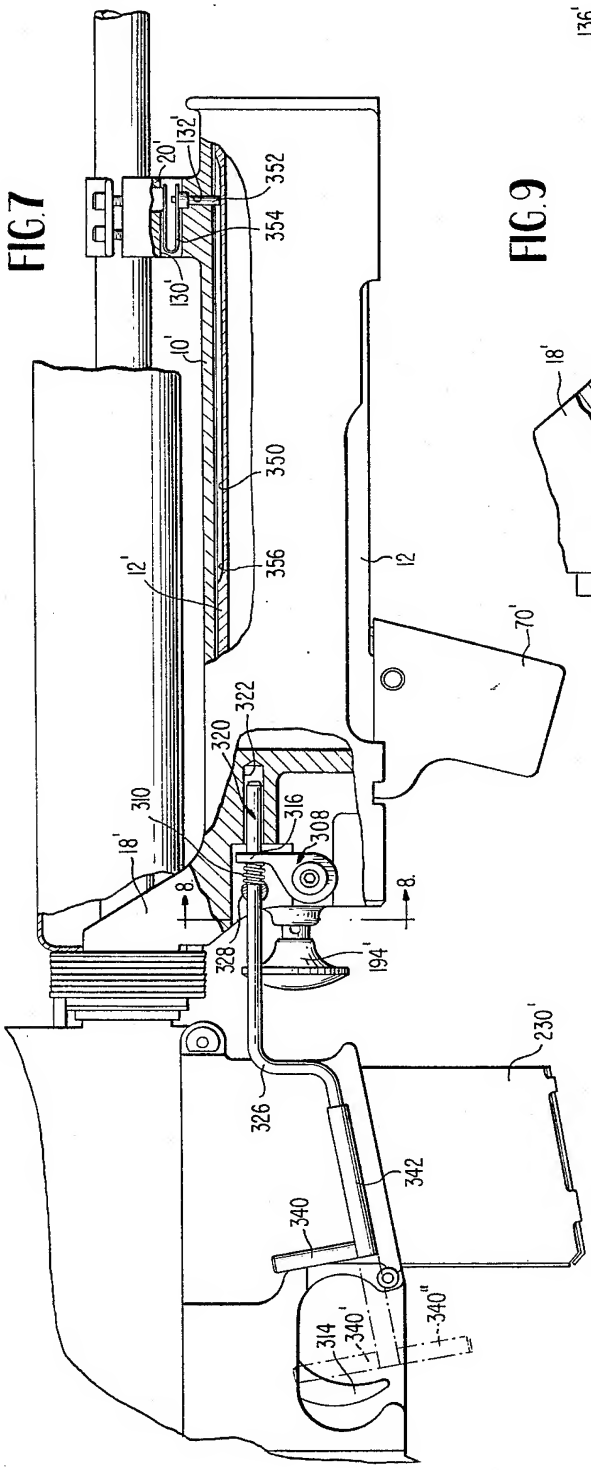


FIG. 9

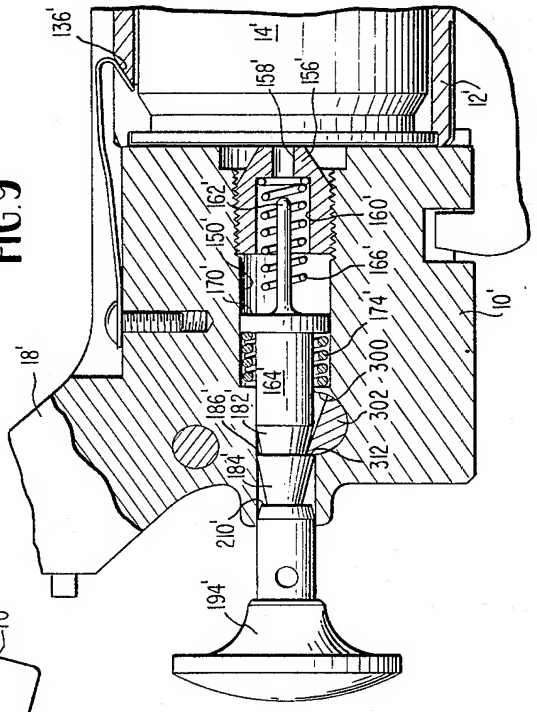
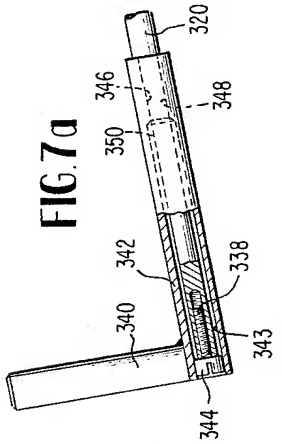


FIG. 7a



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3,279,114

GRENADE LAUNCHER

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Filed Sept. 25, 1964, Ser. No. 401,761
22 Claims. (Cl. 42—1)

This invention relates to a grenade launcher and more particularly to a grenade launcher which may be readily attached to the barrel of a conventional, small caliber rifle, allowing independent rapid firing of grenade cartridges accurately over relatively long range without interference with the normal rifle operation.

There is a present need for a lightweight, inexpensive launcher for grenades of the cartridge type, which may be easily and quickly mounted on the barrel of the standard military rifle, which will operate as a rapid firing weapon, and which is adaptable for projecting smoke and gas shells of similar construction. Since the weapon is to be used in conjunction with a standard infantry rifle, it must not add appreciably to the over-all weight of the rifle-launcher combination and must be easy to manufacture, assemble and maintain and at the same time, be capable of projecting the grenade at a relatively extensive range with extremely high accuracy.

Launcher attachments have been developed which utilize the gas pressure developed by firing of a blank cartridge within the rifle barrel itself for propelling the grenade in a somewhat inaccurate manner and over a relatively short range. It is obvious, that with launcher attachments of this type, the rifle and launcher may not be used contemporaneously but rather, the attachment of the launcher prevents the rifle from being used in a normal manner. Attempts have been made to produce a launcher-attachment which makes use of mechanical means for ejecting or propelling a grenade in cartridge or other form. The mechanical means in most cases consists of a high energy coil spring which is first compressed and then released to eject the cartridge through an associated barrel. Again, these launcher attachments fail to provide the necessary propellent force to deliver the grenade at the range desired, and have the further disadvantage of being highly inaccurate.

It is, therefore, a primary object of this invention to provide a grenade launcher which may be readily and easily attached to a conventional small caliber rifle which does not add appreciably to the over-all weight of the weapon combination, comprises a minimum number of operational parts, and is easy to manufacture and assemble.

It is a further object of this invention to provide an improved launcher of this type which is constructed of materials of high durability and requires relatively low maintenance.

It is the further object of this invention to provide an improved launcher of this type having a positive firing system with full automatic safety provisions.

It is a further object of this invention to provide an improved launcher of this type which includes a barrel assembly, including a pair of concentric cylinders in which a single movement therebetween effectively performs the dual function of loading of the cartridge and locking of the barrel.

It is a further object of this invention to provide an improved launcher of this type which may be readily attached to the rifle in a minimum time period, and which launcher will be retained regardless of shock and impact to which the launcher-rifle combination may be subjected.

It is a further object of this invention to provide an

improved launcher of this type having a positive operating firing system employing manually operable firing means carried by the launcher itself.

Further objects of this invention will be pointed out in the following detailed description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of this invention and the best mode which has been contemplated of applying that principle.

In the drawings:

FIGURE 1 is a slide elevational view, partially in section, of one embodiment of the grenade launcher of the present invention attached to a conventional small caliber rifle.

FIGURE 1*a* is an enlarged, side elevational view, partially in section, of a portion of the apparatus shown in FIGURE 1.

FIGURE 2 is a bottom plan view, of a portion of the launcher-attachment of FIGURE 1 showing the guide means for facilitating rectilinear movement between the concentric barrel and housing members.

FIGURE 3 is a rear elevational view taken along lines 3–3 of FIGURE 1 showing the position of the rear mount with respect to the rifle barrel when the launcher is secured thereto.

FIGURE 4 is a front elevational view of a portion of the apparatus shown in FIGURE 1 taken along lines 4–4 showing a method of clamping the front mount to the barrel of the rifle.

FIGURE 5 is a rear elevational view of a portion of the apparatus of FIGURE 1, showing in particular the relationship of the sear and the firing pin, taken along lines 5–5 of FIGURE 1.

FIGURE 6 is a plan view, in section, of the grip pivot pin and its method of attachment to the launcher barrel.

FIGURE 7 is a side elevational view, partially in section, of a second embodiment of the present invention showing a modified form of the firing control system.

FIGURE 7*a* is an enlarged, side elevational view, partially insection, of the trigger assembly shown in FIGURE 7.

FIGURE 8 is a rear elevational view taken along lines 8–8 of FIGURE 7 showing the firing control linkage.

FIGURE 9 is a side elevational view, partially in section, of the firing pin assembly taken along lines 9–9 of FIGURE 8.

In general, the present invention is directed to a grenade launcher of the type readily attached to a small caliber rifle. The launcher comprises a generally cylindrical housing having a longitudinal bore formed therein and a cartridge loading hole formed intermediate of the ends. A cylindrical cartridge receiving barrel is positioned concentrically within the housing bore for rectilinear movement from a first, retracted, locked position to a second, extended position exposing the cartridge loading hole. A grip member is pivotably coupled to the barrel and a forwardly directing force on the grip pivots the grip, simultaneously unlocking the barrel from the housing and moving the barrel forwardly to expose the cartridge loading hole. Friction means prevent free movement between the barrel and the housing. The housing includes a breech face at the rear of the cartridge loading hole and a firing pin receiving bore extends rearwardly from the breech face within the housing pin includes a pair of spaced sear latching ledges and a sear member is positioned at right angles to the firing pin within the housing with means tending to bias the sear into engagement at the ledge points. A main spring tends to bias the firing pin toward firing position and a rebound spring acts oppositely thereto. A sear button extends exteriorly of the housing for

manual release of the firing pin under the biasing means, in a first embodiment. A spring-biased cover prevents inadvertent firing of the cocked weapon. A manually operated button is coupled to the firing pin for moving the pin into cocked position against the main spring bias.

A simplified mounting arrangement is provided including spaced front and rear mounts for quickly and securely mounting the launcher to a conventional small caliber rifle. In the a second embodiment, a trigger member is positioned adjacent to the rifle trigger and linkage means couple the trigger to the sear for moving the sear to released position against the sear basis.

Referring to the drawings, the improved grenade launcher of the present invention which is most advantageously used as an attachment to a conventional small caliber rifle, comprises two main elements, a generally cylindrical housing member **10** which acts to support an inner, longitudinally slidable barrel **12** which is concentric hereto and adapted to move from a rear or locked position to a forward or open position for allowing the manual loading of a grenade-cartridge **14** of conventional construction. The launcher is attached to the rifle barrel **16** through the use of a rear mount member **18** and a front mount member **20**, both mounts being integrally formed or fixed to the housing **10**. It might be stated that all of the elements of the launcher-attachment assembly are formed of relatively lightweight metal with minimum precision finish to facilitate mass production of relatively simplified design, in which a great number of the parts perform double duty functions. The rear mounting member **18**, FIGURE 3, is generally U-shaped in cross-section and forms an open slot **22** at the top, the width of the slot **22** being slightly in excess of the smallest diameter of the rifle barrel **16**. The outer surface of the rifle barrel, of course, tapers from front to rear, with the integral, one-piece U-shaped mount **18** being slid over the barrel **16** under the conventional hand guard **24** such that the arms of the rear mount **18** encircle the barrel. The launcher is then slid rearwardly until the rear face **26** of the rear mount **18** contacts a grooved surface **28** of a conventional thread nut member **30** associated with the rifle barrel assembly. The configuration of the contact surfaces of the rear mount may, of course, be modified to meet the requirement of any particular rifle with which the launcher-attachment is to be used. In order to positively locate the launcher circumferentially with respect to the barrel **16**, the rear mounting member **18** may be provided with an offset rear surface **32** which may have positioned thereon, a mounting pin **34** adapted to seat within a specially formed pin recess **36** associated with the rifle itself. After the launcher assembly has been slid rearwardly with the arms of the rear mount **18** embracing the rifle barrel **16** and after pin **34** is seated within its locating recess **36** with the face **26** of the rear mounting member abutting nut **30**, the front mounting member **20** is positioned in contact ith the front end of barrel **16** in the manner indicated in FIGURE 4.

FIGURE 4 shows in cross-section a portion of the housing **10** including the formed lower mounting member **20**, the mounting member having a concave opening **38** receiving the lower surface of barrel **16**. The front mount **20** includes a longitudinal slot **40** and a longitudinal bore **42** acting to split the lower mount **20** and giving it some resilience. An upper clamp **44** is generally U-shaped in cross-section and has, in addition, a latching extension **46** which extends down, over and under cooperating flange **48** of mount **20** with the flange **48** acting as a pivot. The other end of the U-shaped clamp **44** has a cooperating flange **50** which receives two spaced bores **52**, the bores receiving independent screw members **54**. In like manner, the opposing mounting member **20** is threaded at **56** such that rotation of the screw members **54** tends to pivot the upper clamp **44** about flange **48** to securely lock the front mount **20** to the rifle barrel **16**. The position of the longitudinal slot and aperture **40** and **42** respectively allows

the mount to be used with rifle barrels of generally the same outside diameter, but differing slightly in diameter.

The use of the simplified clamping arrangement in which only two screws hold the launcher-attachment onto the rifle barrel, permits the launcher-attachment to be completely attached to the rifle in about 45 seconds. The rear mount **18** transfers the launcher recoil to the rifle while the front mount **20** merely holds it in place. In this respect, the provision of slot **22** across the top of the rear mounting member **18** reduces the total holding area or contact area between the rear mount and its associated nut **30** only about 20% and does not materially affect the ability of the rear mount **18** to transfer the full recoil of projectile **14** firing from the launcher to the rifle. While the launcher is preferably designed for attachment to a conventional small arms rifle, the simplified coupling attachment using front and rear mounting members allows the launcher to be readily coupled, in a quick and efficient manner, to weapons other than small arms and may, in fact, be readily attached to any appropriate supporting member.

The concentric barrel and housing arrangement allows maximum surface contact between the relatively moving members during ejection of a used cartridge shell and replacement of a fresh grenade-cartridge. In this respect, the cylindrical housing **10** is provided with a longitudinal groove **60** at its forward and bottom end, see FIGURE 2, the groove **60** acting to receive a forward barrel lug **62** which is integrally formed with the barrel. The lug comprises a rectangular extension which projects radially outward from the cylindrical surface of the barrel. The barrel lug **62** is of a width approximating groove **60** and acts to guide the barrel in its rectilinear movement with respect to the cylindrical housing **10**. A second barrel lug **64** is positioned to the rear of the first lug **62**, in line therewith, and is of equal dimensions. It is apparent that when the cylindrical barrel **12** is in its forward position, the lug **62** will have moved out of the groove **60** at the forward end **66** of the assembly, and the rear lug **64** will then have moved into the groove **60** to retain proper circumferential positioning of the barrel with respect to the concentric housing. Of course, instead of a pair of spaced barrel lugs **62** and **64**, a continuous ridge might be used. However, for purposes of providing as light a weapon as possible, the spaced lugs are preferred.

In order to load the weapon, the barrel must be moved from the rearmost position shown, to a fully open or forward position. In order to accomplish this, the apparatus of the present invention makes use of a single grip member **70** which performs the dual function of locking the barrel in its fully closed operative position to the housing and at the same time provides the means to manually move the barrel relative to the housing. The barrel **12** includes a radial, depending lug **72**, formed integrally therewith. The lug **72** includes a transverse bore **74**, the bore **74** receiving a cylindrical grip pivot pin **76**. The pin has a reduced cross-sectional portion **78** formed intermediate of the ends. The grip **70** may be formed of cast metal and has a hollow interior **80** with an open upper end **82** to receive lug **72**. The grip further includes aligned openings (not shown) on opposite surfaces of the grip through which the free ends of the pin **76** project for the purpose of pivoting the grip about lug **72**, while allowing removal therefrom.

Housing **10** includes a recess **84** which receives a grip locking lug **86** when the grip is pivoted clockwise about the grip pivot pin **76**. It is thus apparent that the grip, since it is pivotably fixed to the barrel **12** and since it includes a locking lug **86** which is received within recess **84** of the barrel, will act to lock the barrel **12** in the rearmost position with respect to the housing **10** in a simplified and expedient manner.

The cylindrical housing **10**, of necessity, includes a relatively large opening or cartridge receiving hole **88** which is really an extension of groove **60** on the under-

surface thereof to allow the insertion of a grenade-cartridge within the barrel when the barrel **12** is moved forward. Opening **88** terminates at the rear, adjacent breech face **90**, the opening **88** being rectangular in configuration. The diameter of the breech face is somewhat larger than the diameter of the barrel so as to provide a contact edge **92** centrally of the hole **88**. The depending barrel lug **72** includes a longitudinal bore **94** which receives a cylindrical grip plunger **96**, the diameter of the plunger **96** closely approximating the diameter of bore **94**. The bore **94** terminates adjacent transverse bore **74**. A semicircular recess **98** connects the transverse bore **74** and the longitudinal bore **94** and acts to receive the head **100** of grip pivot pin retaining plunger **102**. The grip plunger **96** is provided with an inner bore **104** which receives a coil spring **106**, one end of which is seated within the bore **104** and the opposite end acts upon the shoulder **100** of the grip pivot pin retaining plunger **102**. The stem of the retaining plunger **102** is positioned coaxially within the coil spring **106** and the bias of the coil spring tends to position the head **100** of the retaining plunger in contact with the reduced cross-sectional portion **78** of the grip pivot pin **76**.

In addition, the grip plunger **96** has formed therein a groove **108** which extends partially along the outer surface of the plunger. A retaining pin **110** is fixed to the lug **72**, is positioned within the groove **108**, and tends to limit forward and reverse movement of the grip plunger as it moves longitudinally within the bore **94**. The coil spring **106** then acts as a common bias for both the grip pivot pin retaining plunger **102** and the grip plunger **96**. The grip **70** is removable from the barrel **12** by the simplified operation of removing the grip pivot pin **76**, this transverse movement of the pin being of course resisted by the spring biased grip pivot pin retaining plunger **102**.

As mentioned previously, in order to automatically eject a used cartridge shell and to allow manual loading of a new cartridge, the barrel is moved rectilinearly with respect to the housing **10**. Such movement is prevented by grip locking lug **86** being positioned within the recess **84** of the housing **10**. However, by pivoting the grip **70** counterclockwise about grip pivot pin **76**, the grip locking lug will free itself of the recess **84** and slide over radial face **91** of the housing.

The grip **70**, when pivoting counterclockwise about the pivot pin **76**, will be opposed somewhat by the cartridge retainer plunger **112**. The grip **70** is bored at **114** to receive the cartridge retainer plunger **112** which is guided for longitudinal movement within the bore **114** by a slotted transverse guide member **116**. Upon removal of the grip **70** the guide pin **116** coacts with the flared rear portion of plunger **112** for retaining the plunger within bore **114**. The rear face of the cartridge retaining plunger is positioned against a coil spring **118**, the bias of the coil spring tending to force the cartridge retaining plunger out of the bore **114** with the tip **120** passing through a cooperating cylindrical opening **122** within the barrel **12** and against the side of cartridge **14**. Thus, as the grip **70** is pushed forward, it pivots counterclockwise around the pivot pin **76**. The forward pressure on the grip causes the grip locking lug **86** to move outward (down) from the opening or recess **84** in the housing **10**, resisted by the bias of spring **118** and the barrel now telescopes forwardly with the lugs **62** and **64** acting as guide means. At this moment, the grip plunger **96** under the bias of spring **104** moves rearwardly and the face **97** of the grip plunger contacts the ledge **87** of the grip. Continued manual pressure on the grip **70** telescopes the barrel until the grip face **124** hits the face **126** at the bottom of the housing.

In order to prevent accidental return of the barrel from a forward to a rear or closed position prior to loading of the cartridge, frictional means are provided for retaining the barrel in any longitudinal position. A simplified method of accomplishing this purpose is achieved through the use of a barrel friction spring **128** which is seated within a specially formed longitudinal opening **130** of the housing and vertical opening **132** which is at right angles thereto. The barrel friction spring **128** includes a depending U-shaped portion **134** which has a contact surface **136** contacting the top of the barrel **12**, the presence of the barrel tending to contract the spring. The spring force developed is sufficient to hold the barrel **12** in any position longitudinally with respect to the housing **10**. For instance, if the barrel is in the fully opened position, and the rifle-launcher assembly were tilted upwardly at say perhaps 45°, there would be a normal tendency for the barrel to move rearwardly under the force of gravity. The presence of the barrel friction spring overcomes this tendency and the barrel must be manually moved from the front to the rear position. With the barrel friction spring **128** exerting the pressure against the barrel, the hand normally used in moving the grip and associated barrel forward is free to insert a cartridge into the barrel chamber. There is now an exposed opening **88** at the bottom of the housing which permits the cartridge to be inserted into the barrel. The grip **70** is held in the open position by the grip plunger **96** which protrudes outwardly from its bore **94** under the bias of compression spring **106**.

After manual insertion of the cartridge **14** within the barrel **12**, the cartridge will be retained in the chamber through the use of the cartridge retainer plunger **112**, the head **120** of the plunger being forced against the surface of the cartridge **14** and frictionally holding it in position within the barrel by the action of coil spring **118**. Thereby, spring **118** ensures the proper position of the cartridge retainer plunger **112** to provide the friction grip between the cartridge and the barrel. With the cartridge frictionally retained, the operator is again free to now grasp the grip **70** regardless of the incline of the weapon combination. A rearward pull on the grip **70** will cause the barrel **12** to overcome the friction of the barrel friction spring **128**. During loading the grip plunger **96** is lodged against locking lug **86** under the bias of compression spring **106**. At the moment that the locking lug **86** clears the ledge **91**, the grip plunger **96** hits the edge **92** and telescopes back into aperture **94** of the lug **72**. Grip **70** is free to pivot clockwise and continued pressure on the grip causes it to come into the locked position with the grip locking lug **86** received within recess **84** of the housing. At the same time, the grip is held in its clockwise and locked position by the bias of compression spring **118** acting on the cartridge retaining plunger **112**.

The housing **10** has another recess **130** on its upper face, in front of the rear mounting member **18**. This recess receives an extractor in the form of a leaf spring **132**, the leaf spring having a downwardly and rearwardly curved frontal portion **134** which abuts against the tapered rear surface **136** of the barrel **12**. The extractor **132** is fixed at the rear by a conventional threaded screw **138**, the screw being received in a threaded bore within the housing **10**. The barrel **12** includes a cooperating recess **140**. The cartridge **14** is provided with a conventional cartridge rim **142** which is of a slightly greater diameter than the diameter of the main cartridge body and is received within recess **144** of the barrel **12**. Upon rearward movement of the barrel **12** with the cartridge **14** in place, the cartridge rim **142** rides over the tapered surface **134** of the extractor. After firing, and upon forward movement of the grip **70**, there is a tendency to carry the extended cartridge along with the barrel **12**. As the barrel and cartridge move forwardly, the cartridge rim **142** contacts the downwardly projecting spring arm **134** of the extractor momentarily restraining the expended cartridge shell. As the barrel **12** continues to move forwardly, the expended cartridge falls through the opening **88** by gravity prior to the manual loading of a fresh cartridge. The rearwardly inclined terminal portion **134** of the extractor also serves another function. At the

time of closing of the barrel to battery position, the extractor **132** which has passed over the cartridge rim **142** comes to rest firmly against the inclined surface **136** of the barrel. The purpose of this is to cause the extractor, which is really a strong leaf spring, to exert pressure downwardly and thus cause the barrel to come to rest in battery position at the exact same place every time. Thus, the extractor **132** cooperates with the barrel friction spring **128** to securely position the barrel in the same position for each cartridge firing, and in theory, cartridge impact at the target will be the same, all other things being equal.

An important feature of the present invention resides in the firing mechanism. The firing mechanism is positioned concentrically of the housing within the breech block immediately behind the grip. A longitudinal bore **150** is provided centrally of the housing, extending from the rear housing surface **152** to the breech face **90**. The bore **150** includes a forward threaded portion **154** which receives an annular threaded recoil plate **156**. The annular plate **156** includes a forward, relatively small diameter bore **158** and a rearwardly disposed counterbore **160**. The small bore receives the nose **162** of firing pin **164**, while the larger bore houses rebound compression spring **166**. The rear end of the recoil plate includes a recoil plate face **168** which is normally spaced from the opposed firing pin face **170** by compression spring **166**. The firing pin face **170** is formed by enlarged annular portion **169** of the firing pin **164** of slightly less diameter than the diameter of the main section of the bore **150**. The firing pin is further characterized in a reduced cross-sectional portion **172** immediately behind the firing pin face **170** with a main compression spring **174** positioned thereabout. The compression spring tends to force the firing pin forwardly causing the nose **162** to strike the rear surface of the cartridge. The compression spring abuts the shoulder produced by annulus **169** and a shoulder **180** formed by reduced bore section **176** of the housing. The firing pin is further characterized by a first inwardly tapered ramp **182**, and a second inwardly tapered ramp **184**, thus forming a ledge or shoulder **186** therebetween. The inwardly tapering ramp **184** forms a ledge or shoulder **190** spaced rearwardly of shoulder **186**. The terminal pin section **188** is positioned within a coaxial housing bore **192**. The firing pin is moved outwardly of respective bore sections against the bias of main compression spring **174**. A button **194** is threadably attached at **196** to the rearwardly projecting terminal portion of the firing pin **164**.

A bore **198** of uniform diameter is formed within the rear of housing **10** at right angles to the firing pin bore **150**, and receives a cylindrical sear **200**. The sear **200** is provided at the inner end with a central recess **202** within which is positioned compression spring **204**, the inner end of which seats at the bottom of bore **198**. The cylindrical sear **200**, as seen in FIGURE 5, includes a rectangular central aperture **206** through which passes the firing pin **164**. The recess **206** is rectangular in cross-section and is diagonal, thereby providing an upper tapered sear contact surface **208** terminating in a sear edge **210**, the sear edge tending to position itself adjacent shoulder **190** or **186** depending upon the longitudinal position of the firing pin **164**. The outer end **212** of the sear projects beyond bottom wall **214** of the housing **10** within recess **216**. The sear includes a button **218** affixed thereto, the button moving with the sear and acting to compress the biasing spring **204** to release the firing pin **164** when it is cocked. In order to prevent inadvertent firing, a safety hinge **219** has one end **226** fixed to the housing by screw **220**. The other end **228**, which is concave, acts to cover the sear button **218**. A spring **224** is secured at one end to the fixed portion **226** of the hinge assembly while the other end is affixed to the pivotable cover **228**. The spring **224**, therefore, tends to keep the cover in a closed position in line with the fixed end **226** unless the cover is pivoted counterclockwise against the spring bias.

The firing pin **164**, as shown, is in a neutral position. The main spring **174** is exerting no pressure. The rebound spring **166** is pushing rearwardly at one or two pounds pressure so that the firing pin nose **162** will not be exposed, being fully protected within bore **158**. The bias of the rebound spring is also sufficient to push the firing pin **164** rearwardly to the extent that sear edge **210** will be positioned within the notch formed by shoulder **190**. The positioning of sear edge **210** in front of shoulder **190** will keep the firing pin from moving forward and accidentally firing a cartridge if firing pin button **194** should receive a blow.

In order to fire the launcher cartridge, the button **194** is pulled rearwardly causing firing pin **164** to move rearwardly against the bias of the main compression spring **174**. (If the operator's fingers should slip off the button before the sear **200** reaches the cocking notch formed by shoulder **186**, the sear under the bias of compression spring **204** will ride down on ramp **184** and being in line with shoulder **190**, the sear edge **210** will stop forward movement of the firing pin and the cartridge, of course, will not fire.) Continued rearward manual movement of the button **194** will cause the sear **200** to climb the ramp **184** and as soon as a notch formed by shoulder **186** clears the sear edge **210**, the sear will drop onto ramp **182** and the firing pin button **194** may be released with the firing pin **164** remaining cocked.

The enlarged button **218** provides a large surface to push against to fire the launcher. The safety hinge which normally protects the cocked sear from being accidentally fired is rotated counterclockwise against the biasing spring. To fire the launcher, the operator may rest the palm of his hand against the gun at the clip area indicated at **230** and with his forefinger, push against the outer ledge **232** of the safety hinge **220**. The hinge will resistingly move out of the way of the finger, thus exposing the button **218** for actuation of the sear **200** to effect release of firing pin **164**. The firing pin **164** moves forward, overcoming the bias of the rebound spring **166** and the nose **162** will protrude past the breech face **90** and fire the cartridge **14**. Predetermined forward movement of the firing pin **164** is controlled by the firing pin face **170** and the recoil plate face **168**. The firing pin **164** will rebound as the result of impact. However, the rebound spring **166** which is compressed during this forward movement will make sure that the firing pin will rebound sufficiently to permit the spring-biased sear **200** to automatically lodge itself in front of the firing pin ledge **190**.

In firing the weapon, push button **218** is moved inwardly, which moves sear **200** within the bore **198**, thus releasing the firing pin. Overtravel is prevented due to the fact that the coil spring **204** is provided with a predetermined number of coils such that it will be compressed to solid height after sufficient movement of the sear pin to release the firing pin. Alternatively, the inner end **203** of the sear could bottom out against the bottom of the bore **198** to prevent trigger overtravel.

The firing pin and miscellaneous parts are installed through the breech face **90** of the main housing **10** and the recoil plate **156** is screwed into place. The button **194** is, of course, screwed on after the firing pin and associated mechanism has been installed. The sear **200** with its compression spring **204** is inserted into the bore **198** before insertion of the firing pin such that assembly in the order of FIGURE 5 is accomplished.

In the embodiment shown in FIGURES 1 through 6 inclusive, the firing system including the trigger is compactly incorporated at the rear of the launcher itself. In a second embodiment shown in FIGURES 7 through 8 inclusive, the grenade launcher is generally identical in construction to that of the first embodiment with the main exception of the firing system and in particular the trigger means. Referring to these figures in the drawings,

the grenade launcher again includes a cylindrical housing **10'**, a concentric, relatively movable barrel **12'** with the housing **10'** including a front mounting member **20'** and a rear mounting member **18'**. The launcher-attachment employs the identical, attachable grip **70'** and is mounted for quick attachment-detachment to a conventional small caliber rifle in the identical manner as the first embodiment. The rear end of the launcher-attachment includes a main, longitudinally extending, central bore including a main section **150'** which acts to receive a firing pin **164'** which is generally the same as the firing pin of the first embodiment. Unlike the firing pin of the first embodiment, it is not semi-rectangular in cross-sectional configuration but is completely round. In addition, instead of the housing **10'** being provided with a vertically extending second bore at right angles to the firing pin bore **150'**, the housing is provided with a horizontally extending bore **300** at right angles to the firing pin bore **150'**. The bore **300** holds a rotatable sear **302** which includes a grooved central portion forming the sear edge **312** and reduced diameter end **304** which extends outwardly, away from the side of the housing **10'**. By reference to FIGURE 8, it is seen that the housing **10'** is cut away as at **306** to receive a sear lever **308** which is fixed to the protruding end **304** of the sear and is adapted to rotate therewith.

The method of cocking the firing pin **164'** and its operation after firing is identical to that of the previous embodiment. As the button **194'** is moved rearwardly, the firing pin **164'** will move rearward resisted by main spring **174'**. Continued rearward movement of the button **194'** will cause the sear to rotate counterclockwise due to the inclined ramp **184'**, the rotation of the sear **302** being resisted by coil spring **310**, FIGURE 7. The sear edge **312** will fall off of ramp **184'** onto ramp **186'** with the sear **302** rotating clockwise and the firing pin **194'** may be released with the firing pin remaining in the cocked position as shown in FIGURE 9. The firing pin **164'** moves forward under the bias of main spring **174'**, when fired, with the pin nose moving through recoil plate aperture **158'** to detonate the charge within the cartridge **14'**. The recoil plate **156'** includes a counterbore **160'** holding the recoil spring **166'** which acts on the firing pin face **170'** to move the firing pin **164'** sufficiently to the rear to allow the biased rotating sear **302** to move its sear edge **312** into contact with safety notch **210'**.

The principal difference in the firing system of the second embodiment resides in providing means whereby the launcher may be fired from approximately the same position as the rifle itself, that is, by means placed adjacent the conventional rifle trigger mechanism. The sear lever **308** has a pair of upwardly extending fingers **316** formed by a central, vertical slot **318**, with the fingers **316** passing on each side of the trigger bar **320**. The elongated trigger bar **320** is round in cross-section but is milled flat in the area of the sear lever **308** to form a loose but restrictive connection between it and the sear lever.

The trigger bar **320** extends rearwardly and downwardly adjacent magazine **230'**. An S-curved section **326** is coupled to trigger **340** by a trigger support member **342**. Opening **322** within housing **10'** and trigger bar guide rod **328** act to position the trigger bar and attached trigger **340** for limited longitudinal movement.

Thus, the trigger **340** may be extended to the phantom view position **340'**. The trigger support member **342** is cylindrical and includes a rear bore **343** of approximately the same diameter as the diameter of head **344** of the screw **338**, FIGURE 7*a*. The trigger support bar has a front bore **346** of smaller diameter, approximately the same as the reduced cross-sectional portion **348** of the trigger bar **320**. This provides a shoulder **350** intermediate of the two bore sections **343** and **346**. Thus, the trigger may normally be positioned in the full line position shown but prior to operating the launcher, the trigger **340** is grasped and moved to the rear position **340'** immediately adjacent the rifle trigger **314**. In moving rearwardly, the operator must overcome the friction between head **344** of screw **338** and the enlarged bore section **342** of the trigger support member **340**. This friction developed requires about 15 pounds' force to reposition the trigger from the phantom position **340'** to the position **340** stowed adjacent the clip well **230'** and vice versa. If the operator has mittens on and cannot conveniently grasp the trigger in the position shown at **340'**, the trigger may be rotated to the phantom position **340''**, a full 180° rotation.

The trigger return spring **310** pushes the sear lever **308** forward and the sear lever being attached to the sear rotates the sear **302** clockwise into firing pin safety notch **210'** automatically after firing due to action of rebound spring **166'** in the manner explained in the earlier launcher description.

To fire the launcher of the second embodiment, the cocking button **194'** is pulled rearwardly. When the cocking notch **186'** clears the sear edge **312**, the trigger return spring **310** pushing against the sear lever fingers **316** causes the sear **302** to rotate in front of cocking notch **186'**. The button **194'** may then be released and the launcher is ready to fire. A rearward pull on trigger **340** will pull the sear lever **308** to the rear, tending to rotate the sear **302** counterclockwise releasing the firing pin. The firing pin under the bias of main spring **174'** will fire the catridge. Rearward movement of the trigger **340** is controlled after the firing pin is released by the trigger return spring **310**. The trigger return spring **310** is provided with a predetermined number of coils in the predetermined space between fingers **316** and the trigger bar guide rod **328**, thus rearward movement of the trigger bar guide rod **328**, thus rearward movement of trigger **340** is limited to the point where the spring **310** is compressed to solid height. This restriction of overtravel reduces jerking of the gun and increases accuracy. The firing pin will return to the neutral position by the pressure of the rebound spring **166'** and upon releasing the trigger **340**, the bias of the compressed coil spring **310** will cause the sear **302** to rotate into a position where a sear edge **312** moves into the safety notch **210'**. Thus, the trigger system permits the operator to fire the launcher with the same hand that actuates the trigger **314** on the rifle. As is evident from viewing FIGURE 8, the rebound spring **166'** remains within the bore **160'** of the recoil plate **156'**. This is achieved by making the innermost coil of the rebound spring **166'** slightly larger in diameter than the diameter of the bore **160'** so that the spring is forced into position and stays there. This feature may also be provided in the apparatus of the first embodiment.

In the previous embodiment, it was necessary to provide a pair of narrow guide lugs **62** and **64** for ensuring proper orientation of the barrel with respect to the housing during the reciprocating movement therebetween. In the second embodiment, the lugs have been removed. However, the problem of guiding the barrel remains, as the same telescoping motion is utilized in loading the weapon.

In like manner to the previous embodiment, the housing **10'** at the forward end includes cooperating horizontal and vertical bores **130'** and **132'**. However, the top of the barrel is dissimilar in that a longitudinal slot **350** is provided running a predetermined length of the barrel, and a pin **352** having a diameter slightly less than the diameter of vertical bore **132** is provided within bore **132'**, the width of the slot **350** being slightly greater than the diameter of pin **352**. A U-shaped spring **354** is positioned within the horizontal bore **130'**, the spring **354** having one end fixed to the pin **352**. The U-shaped spring is compressed and thereby exerts a downward force upon the pin **352** effecting frictional engagement between the pin **352** and the bottom of the slot **350**. Thus the pin **352**

exerts a drag on the barrel and also tends to guide and position the barrel circumferentially during the reciprocating movement. Since the pin exerts a drag on the barrel, it causes the barrel to remain positioned in any position, especially when the barrel is fully extended, allowing the operator's hand to be free to load a cartridge into the chamber. At the end of the slot **350**, the natural radial cutter run-out **356** permits the barrel to be removed from the housing merely by forcing the pin up and out of the run-out **356** against the bias of spring **354**. The barrel **12'** is just as easily inserted into the launcher housing **10'** by the guide pin **352** sliding up the inclined plane **136'**, FIGURE 9, of the barrel.

From the above description, it is apparent that the apparatus of the present invention, in both embodiments, provides an extremely simple, light, compact and durable grenade launcher which may be readily coupled to a conventional small caliber rifle or the like which operates completely independent of the rifle but does not interfere in the normal rifle operation. The launcher-attachment has its own positive firing system with full automatic safety provisions and the launcher-attachment may be subjected to extreme shock with no danger of inadvertent firing even though the weapon is fully cocked. Both embodiments disclose a number of features which may be incorporated in other weapons not limited to grenade launcher-attachments. Thus, features having special application here, have general application to weapon systems, these featuers residing primarily in the simplified loading and locking technique, the removable dual function grip, the firing mechanism and the launcher-attachment means.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

We claim:

1. A grenade launcher of the type readily attached to a small calber rifle comprising: a generally cylindrical housing having a longitudinal bore formed therein, a cartridge loading hole formed within said cylindrical housing, a barrel, means for positioning said barrel concentrically within said bore, guide means for allowing rectilinear movement between said barrel and said cylindrical housing to expose the cartridge loading hole, and common means coupled to said barrel for moving said barrel forwardly to expose said cartridge loading hole and for simultaneously unlocking said barrel from said housing.

2. A grenade launcher of the type readily attached to a small calber rifle comprising: a generally cylindrical housing having a longitudinal bore formed therein and a cartridge loading hole positioned therealong, a cylindrical, cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement only between said barrel and said housing from a first retracted, locked position to a second, extended position whereby said cartridge loading hole is exposed, and common means coupled to said barrel and movable therewith for moving said barrel from said first position to said second position and for simultaneously unlocking said barrel from said housing.

3. A device as claimed in claim **2** wherein said housing further includes catch means positioned rearwardly of said cartridge loading hole, and said common means includes a grip member pivotably connected to said barrel for rotation about an axis at right angles to said barrel axis, latch means carried by said grip member whereby a forwardly directed force on said grip member results in pivoting of said grip member about the pivot axis releasing said latch member from said catch member while simultaneously moving said barrel forwardly with respect to said housing.

4. A grip assembly for use with a grenade launcher having a pair of concentric cylinders, one of said cylinders forming a housing including a longitudinal bore, said other cylinder forming a cartridge receiving barrel positioned concentrically within said bore and movable longitudinally with respect thereto from a first retracted, locked position to a second, extended position exposing a cartridge loading hole within said housing, said hand grip assembly comprising: a grip member, means for pivotably mounting said grip member to one of said relatively movable cylinders for movement about an axis at right angles to the axis of said cylinder, catch means formed on said second cylinder member, latching means formed on said grip, biasing means tending to rotate said grip member about said pivot point so as to engage said latch means with said catch means, whereby direct force delivered to said grip member tends to rotate said grip member in the opposite direction about said pivot point to unlock one cylinder with respect to the other and allow rectilinear movement therebetween.

5. A device as claimed in claim **4** wherein a recess is formed within said grip member, a plunger positioned within said recess and means biasing said plunger in an extended direction toward said cylinder upon which the grip member is pivoted.

6. The device as claimed in claim **5** further including biasing means coupled to said cylinder carrying said grip member and normally engaging said other cylinder but operable upon rotation of said grip member about said pivot point to engage said grip member in its rotated position to retain said grip member in said position in opposition to said biased plunger carried within said grip member whereby when moving said one cylinder from extended to retracted position said latch means is free to move to latching position with respect to said catch means.

7. The device as claimed in claim **4** wherein said one cylinder member carrying said grip member includes a radial projection, a transverse bore formed within said projection means at right angles to the cylinder axis, a pivot pin passing through said grip member positioned within said bore allowing limited rotation of said grip member about said transverse pin axis, said pin including reduced cross-sectional portion, a second longitudinal bore extending away from said first bore at right angles thereto, a grip pivot pin retaining plunger positioned within said second bore and means for biasing the head of said grip pivot pin retaining plunger into engagement with said reduced cross-sectional portion of said pivot pin to normally prevent removal of said grip from said cylindrical member.

8. A device as claimed in claim **7** wherein said longitudinal bore within said projection further includes a grip plunger positioned therein concentric to grip pivot pin retaining plunger, said biasing means for biasing said grip pivot pin retainer into engagement with said reduced cross-sectional portion of said pivot pin also biasing said plunger in the opposite direction toward said grip latch means whereby, after said grip member rotates about said pivot pin in one direction from a locked to an unlocked position and said cylinders are free to move relative to each other, said plunger acts to prevent rotation in the opposite direction.

9. In a grenade launcher for ready attachment to a small caliber rifle, a generally cylindrical housing having a longitudinal bore formed therein and a cartridge loading hole positioned therealong, a cylindrical, cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement of said barrel with respect to said housing from a first retracted, locked position to a second, extended position exposing said cartridge loading hole, an annular breech face formed within said housing member at one end of said cartridge loading hole with said cylindrical barrel abutting said breech face in said retracted, locked position, a longitudinal bore formed centrally of said housing and extending

rearwardly from said breech face, a firing pin positioned within said bore, means tending to bias said firing pin in a neutral position, sear means carried by said cylindrical housing adjacent said firing pin and cooperating therewith to hold said firing pin in cocked position against said biasing means and trigger means coupled to said sear and extending exteriorly of said housing at the rear end thereof, to allow manual relative movement of said sear with respect to said firing pin, thereby providing a positive firing system.

10. A grenade launcher of the type for ready attachment to a small caliber rifle comprising: a generally cylindrical housing having a longitudinal bore formed therein and a cartridge loading opening positioned therealong, a cylindrical cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement of said barrel with respect to said housing from a first, retracted, locked position with the inner end of said barrel positioned adjacent to an annular breech face formed by said housing, to a second, extended position away from said breech face exposing said cartridge loading opening, a relatively small bore formed within said housing at the rear end thereof and extending away from said breech face, a firing pin positioned within said bore for movement from an outward, cocked position to an inward firing position in which the nose thereof contacts a cartridge positioned within said barrel, a main spring positioned within said bore concentric to said firing pin and tending to move said firing pin to firing position, a rebound spring spaced from said main spring, operatively positioned with respect to said firing pin and acting in opposition to said main spring, a first tapered ramp formed on said firing pin terminating rearwardly in a first ledge for holding said locking pin in cocked position, a sear including a sear edge positioned within said housing for relative movement into and out of locking engagement with said firing pin, a second inclined ramp on said locking pin rearward of said first tapered means and forming a second ledge therealong, the position of said second ledge being such as to prevent the firing pin extension from contacting the cartridge as a result of disengagement of said sear edge and said first ledge.

11. The device as claimed in claim **10** wherein said sear is spring-biased into engaging position with said firing pin and said sear further includes means extending away from said housing for manual movement of said sear against said bias to release said cocked firing pin for firing said launcher.

12. The apparatus recited in claim **11** wherein said means extending away from said housing comprises a sear button and said apparatus further includes a pivotable safety cover extending over said sear button, said safety cover being hinged to said housing, means for spring-biasing said hinge in covering position whereby manual rotation of said hinge cover away from said button acts to uncover said button for allowing manual access to said firing mechanism.

13. A positive firing system for a grenade launcher or the like including a cylindrical housing having a cartridge receiving chamber at the forward end and an annular breech face immediately therebehind, a firing pin receiving bore formed within said housing and extending from said breech face rearwardly, said firing pin bore including a first section of relatively small diameter, a second section of enlarged diameter, a third section of largest diameter, and a fourth section of intermediate diameter, a firing pin positioned within said bore including a pin nose of a diameter slightly less than the diameter of said first bore section, an enlarged annular section positioned within said third bore section of a diameter slightly less than the diameter of said third bore and a section extending rearwardly therefrom of reduced diameter, a main spring positioned within said third bore section, concentric to said firing pin and positioned behind said annulus, a rebound spring positioned concentrically of said pin nose within said bore second section tending to move said firing pin rearwardly, said firing pin being tapered at two adjacent points to form inclined ramps terminating in ledges, a sear member positioned within said housing and having a sear edge movable into engagement with a selected ledge, means biasing said sear into engagement, means for moving said firing pin rearwardly against the bias of said main spring to latch said firing pin in cocked position, said rearward ledge tending to catch said sear upon accidental disengagement of said sear in said forward ledge to prevent inadvertent firing of said cartridge as a result of shock to said weapon.

14. A grenade launcher for ready attachment to a small caliber rifle comprising: a generally cylindrical housing having a longitudinal bore formed therein, a cylindrical, cartridge receiving barrel positioned concentrically within said bore, means for allowing rectilinear movement of said barrel with respect to said housing from a first, retracted, locked position to a second, extended position for exposing a cartridge loading hole, common means coupled to said barrel and movable therewith for moving said barrel from said first to said second position and for simultaneously unlocking said barrel from said housing, a positive firing mechanism carried by said housing including a spring-biased, manually movable firing pin having at least one sear cocking detent formed thereon, a sear member carried by said housing, means biasing said sear into firing pin engaging position to hold said firing pin in cocked position, a manually operable trigger for moving said sear in opposition to said bias for positively firing said weapon, said housing further including at the rear end thereof, a generally U-shaped rear mount having a contact surface at the rear thereof for positive contact with a portion of said barrel for limiting rearward movement, a front mounting member including a U-shaped barrel receiving notch, a clamp, said clamp and said front mount acting to embrace said barrel, and means for moving said clamp toward said front mount whereby said grenade launcher may be rapidly attached and detached from said rifle.

15. Attaching mechanism for attaching a grenade launcher or the like to a small caliber rifle having a longitudinally extending barrel including shoulder means at the inner end of said barrel of a larger diameter than the forward portion of the barrel, the attaching mechanism comprising: a rear mount coupled to said launcher and extending upwardly from the rear thereof, said rear mount of U-shaped cross-sectional configuration, slotted across the top, the width of said slot being in excess of the smallest outside diameter of said rifle barrel, said rear mount further including a flattened rear surface for engagement with the shoulder means formed on said rifle barrel, an upwardly extending front mount including a generally U-shaped portion opening upward to receive the forward end of said rifle barrel, a cooperating U-shaped clamp, means for pivotably attaching said clamp to said lower front mount, and at least one screw member coupling the opposite side of said upper clamp to said lower mount whereby said launcher may be easily attached to said rifle by first allowing said rear clamp to embrace the forward portion of said rifle barrel and longitudinally sliding said launcher rearwardly of said rifle until said rear mount contacts the shoulder means whereupon said front clamp is secured to said front mount.

16. A positive firing system for a grenade launcher of the type readily attached to a small caliber rifle, the grenade launcher including a cylindrical housing to be mounted on the rifle below the rifle barrel and including a section at the rear having an annular breech face adjacent the cartridge chamber, a bore formed within said housing extending rearwardly away from said breech face, a firing pin positioned within said bore, means tending to bias said firing pin into said firing position, a cocking ledge formed on said firing pin, a second bore formed transverse to the first bore, a rotatable sear positioned

within said bore and having a sear edge for movement into engagement with said cocking edge of said firing pin, means for manually moving said firing pin rearwardly against said biasing means and means tending to rotate said sear into engagement with said cocking ledge after cocking, and means coupled to said sear and extending exteriorly of said housing, said means adapted for manual rotation against said biasing means to rotate said sear and release said firing pin to fire the grenade launcher.

17. The firing mechanism as claimed in claim **16** further including a sear lever fixed to said rotatable sear and extending radially therefrom exterior of said housing, a trigger bar, means for positioning said trigger bar in juxtaposition to said sear lever, said trigger bar extending away from said sear lever toward said rifle stock and terminating in the vicinity of the rifle trigger assembly, a trigger member, means for coupling said trigger member to said trigger bar whereby movement of said trigger bar tends to rotate said sear lever about said sear against said biasing means to release said cocked firing pin.

18. The firing mechnism as claimed in claim **17** wherein said trigger member includes a cylindrical extension portion, one end of said trigger bar being received within said cylindrical extension portion and means for frictionally coupling said trigger bar to said cylindrical trigger extension, means allowing limited, longitudinal movement of said cylindrical extension whereby said trigger may be resistingly moved from a position adjacent said rifle trigger to a position displaced longitudinally therefrom.

19. The positive firing mechanism described in claim **18** wherein said trigger bar is coupled to said sear lever for longitudinal movement thereto but is prevented from rotation therewith.

20. A grenade launcher of the type readily attached to a small caliber rifle comprising: a generally cylindrical housing including a breech block and a longitudinal bore formed forwardly thereof, a cartridge loading hole formed within said housing with the rear end of the loading hole terminating adjacent the breech block, a cylindrical cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement between said barrel and said housing from a first retracted position to a second extended position whereby said cartridge loading hole is exposed, means for locking the barrel to the breech block including a grip pivoted on said barrel so as to be movable in a releasing direction by a force in the direction to move the barrel away from the breech block toward said cartridge loading position, and manually operated firing means carried by said breech block.

21. A grenade launcher of the type readily attached to a small caliber rifle comprising: a generally cylindrical housing including a breech block having a longitudinal bore therein, and a longitudinal bore formed forwardly thereof communicating with the bore in said breech block, a cartridge loading hole formed within said housing

with the rear end of the loading hole terminating adjacent the breech block, a cylindrical cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement between said barrel and said housing from a first retracted position to a second extended position whereby said cartridge loading hole is exposed, means for locking the barrel to the breech block and manually operated firing means carried by said breech block, said firing means comprises a firing pin positioned within said bore, means tending to bias said firing pin in firing position, a manually movable sear carried by said breech block, and means carried by said firing pin and cooperating with said sear to hold said firing pin in cocked position in opposition to said firing pin biasing means.

22. A grenade launcher of the type readily attached to a small caliber rifle comprising: a generally cylindrical housing including a breech block and a longitudinal bore formed forwardly thereof, a cartridge loading hole formed within said housing with the rear end of the loading hole terminating adjacent the breech block, a cylindrical cartridge receiving barrel positioned concentrically within said bore, guide means for allowing rectilinear movement between said barrel and said housing from a first retracted position to a second extended position whereby said cartridge loading hole is exposed, a vertical opening formed in said housing and a spring member is positioned within said housing having a portion spring-biased in contact with said barrel through said opening in said housing member whereby said barrel is frictionally prevented from free rectilinear movement with respect to said housing.

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